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Appendix A: Recommended Techniques

Recommended Techniques - Design

Landscape & Site Design

- Limit heat build-up by orienting longer sides of the home north and south.
- Use existing or new landscape elements (trees) to shade the building.
- Shade hardscapes, such as walls and paved areas.
- Limit area of unplanted and paved exterior surfaces. Provide generous areas of planting and ground cover to help reduce site temperatures.
- Use porous paving materials to reduce thermal mass, heat gain, and glare.

Roofs

- Shade roof to prevent heat build-up.
- Use roofing materials that reflect the sun's heat rather than absorb and transfer it to the home's interior.
- Insulate ceilings and attic spaces.
- Install radiant barriers in ceilings and attic spaces.
- Ventilate roof properly.
- Integrate roof strategies.

Walls

- Use design elements to shade walls.
- Use light-colored wall finishes.
- Insulate walls exposed to the sun.
- Install radiant barriers in walls exposed to the sun.

Windows and Other Openings

- Shade windows and other openings.
- Use high performance glazing on windows exposed to the sun.
- Limit area of openings.
- Use skylights with great care.

Airflow Around Buildings

- Orient buildings to maximize the cooling potential of prevailing winds.
- Provide ample spacing between buildings in the direction of wind flow so that all structures have good air flow.
- Arrange buildings to provide for good air flow around all structures.
- Use landscaping elements such as trees, fences, and hedges to improve air flow around structures.

Airflow in Buildings

- Design floor plans that provide effective cross ventilation and good circulation at body level.
- For spaces with openings on opposite walls orient the room 45 degrees from the wind direction.
- Keep inlet openings slightly smaller than outlet openings.
- For spaces with openings on adjacent walls place windows far apart and at a diagonal.

- For spaces with openings on the same wall use casement windows or wing walls spaced as far apart as possible.
- Locate windows at body level.

Recommended Techniques – Energy Efficient Equipment & Appliances

Water Heating

- Install solar water heating.
- Install water-conserving fixtures and appliances.
- Properly size water heating equipment.
- Select high performance water heating equipment.
- Provide for efficient operation and maintenance.

Daylighting

- Minimize difficult-to-shade east- and west-facing windows.
- Design interior layouts to match lighting needs to daylight availability.
- Use light-colored interior finishes effectively.
- Design floor plans to allow deep daylight penetration.
- Uses light shelves when sidelighting.
- Rely on clerestories for toplighting.
- Prevent heat gain and glare when installing skylights.

Electric Lighting

- Design for effective electric light delivery.
- Use fixtures that accept fluorescent bulbs.

Appliances

- Select energy efficient refrigerators.
- Select energy-efficient cooking appliances.
- Select energy-efficient laundry equipment.
- Select energy-efficient dishwashers.

Air Conditioning

- Use air conditioning only when absolutely necessary.
- Employ passive cooling strategies to reduce cooling load.
- Seal the building envelope against energy leaks.
- Select AC systems with a seasonal energy efficiency ratio (SEER) of 12 or higher.
- Properly size the AC system.
- Zone and control the AC system.
- Ensure AC system provides a generous supply of fresh air.
- In central AC homes, ensure balanced airflow.
- When installing central AC, seal ducts to avoid leaks.
- When installing window units, optimize performance.
- Install the AC system so it can easily be maintained.

Appendix B: Resources

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The Health House Workbook: A Homeowner's Manual for Building a Healthier Home. Published by the American Lung Association, 490 Concodia Avenue, St. Paul, MN 55103. 651-227-8014.
www.healthhouse.org.

Section IV

Ceiling Insulation for Your Home. Developed by Eley Associates for DBEDT, 1998.
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Cooling Our Communities: A Guidebook on Tree Planting and Light-Colored Surfacing. Berkeley Lab Report LBL-31587, January 1992. To order, write to: Superintendent of Documents, Attn: New Orders, P0 Box 371954, Pittsburgh, PA 15220 and request GPO Document Number 055-000-00371-8.

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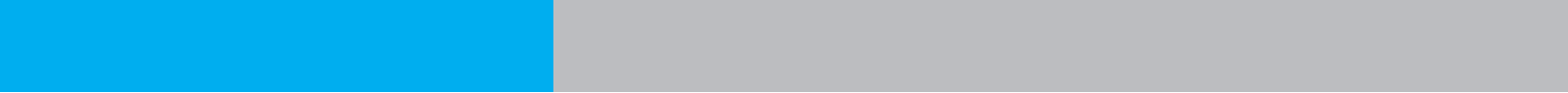
Environmental Building News. A leading newsletter of the green building industry. For subscription information, contact Environmental Building News, 122 Bridge St., Suite 30, Brattleboro, VT 05301. 802-257-7300. E-mail: ebn@ebuild.com.

Green House Hawaii Project. Provides lists of earth friendly products and materials and offers a traveling exhibit of materials. See the DBEDT Clean Hawaii Center web site (www.state.hi.us/dbedt/ert/chc/index.html) for materials list and exhibit schedule.

Green Spec: The Environmental Building News Product Direct and Guideline Specifications. Organized by building divisions, provides model specifications environmentally friendly product ideas for each division. Published by *Environmental Building News* (see above).

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National Association of Home Builders Research Center. Conducts research on aspects of green building and sponsors an annual green building conference. For information, contact the NAHB Research Center at 400 Prince George's Blvd., Upper Marlboro, MD 20774-8731. 301-249-4000. www.nahbrc.org.



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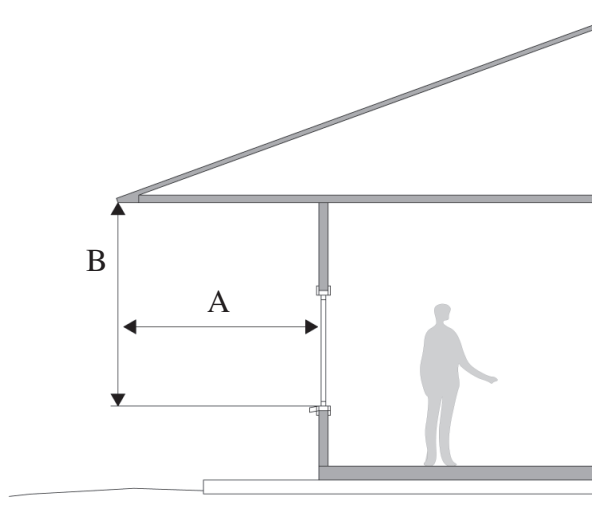
Appendix D: Shading Formulas

The Projection Factor (PF) is an index of the size of a shading device relative to the window it is protecting. The PF helps to determine how well a window will be shaded.

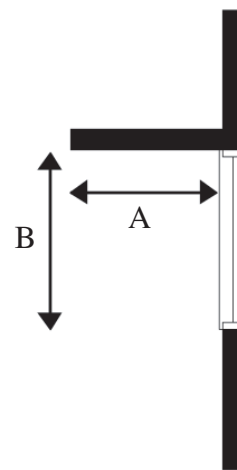
For horizontal shading devices, the PF is the distance that the overhang projects past the surface of the glass (A), divided by the distance from the bottom of the window to the bottom of the overhang (B).

For vertical shading devices, the PF is the distance the fin projects from the wall (A), divided by the distance from the far window jam to the fin (B). The fin should also extend above the window head a distance at least equal to the side fin projection.

For best results in both cases, you want the PF to be 0.5 to 1.0 (with 1.0 providing the most protection all year round).



Projection factor for horizontal shading devices



Projection factor for vertical shading devices (plan view)



Appendix E: Operations and Maintenance

Introduction

A home that is built to high energy-efficiency standards will *be* energy-efficient only to the extent that you, the homeowner, operate your home in an energy efficient manner and keep your equipment well maintained. Besides conserving energy and reducing your energy bills, proper maintenance keeps equipment running well and extends its service life, reducing repair and long term replacement costs as well.

To help you operate and maintain the equipment in your home to peak energy-efficiency, this appendix provides:

- “Do’s and Don’ts” for operating the equipment in your home in an energy-efficient manner.
- Maintenance guidelines for air conditioners, hot water heaters, and major appliances.

To properly operate and maintain your equipment, it is important to understand how the equipment or system works. Be sure to review information provided by the manufacturer. And if there is a conflict between manufacturer’s operational or maintenance recommendations and these general guidelines, *follow the manufacturer’s recommendations*.

Operating Do’s and Don’ts

Air Conditioners

The best way to conserve energy and the life of your air conditioning equipment is to use air conditioning only when natural ventilation is inadequate. Here are some ways to minimize the need for air conditioning in your home.

Do's	Don'ts
<ul style="list-style-type: none"> • Use natural or forced ventilation at night, while keeping the house closed up tight during hot days. • If your air conditioner has an outside air option, use it sparingly. • Always keep all doors and windows closed when operating an air conditioner. • Use ceiling fans to increase your comfort range. (You will probably be comfortable with the thermostat set at about 78°F. You will save 3% to 5% on air conditioning costs for each degree that you raise the thermostat.) • Reduce humidity to increase comfort. (For example, use a bathroom exhaust fan when you shower.) • Diligently perform recommended periodic maintenance to keep your system running at peak efficiency. • Reduce the cooling load: <ul style="list-style-type: none"> • Consider additional landscaping to provide additional shading for east and west windows. • Use energy efficient lighting and appliances. • Add insulation and sealant around doors and windows. 	<ul style="list-style-type: none"> • Don't cool unoccupied rooms (but don't shut off too many registers with a central system either, or the increased system pressure may harm the compressor). • Don't operate a whole-house fan or window fans while using the air conditioner.

Operating Tips for Window Air Conditioners

Do's	Don'ts
<ul style="list-style-type: none">• Set your thermostat as high as comfortably possible.• On very humid days, set the fan speed on low. With the slower air speed through the cooling equipment, the unit will remove more moisture from the air and provide better cooling.• Use an interior fan to help distribute the cooled air. With improved air movement, thermostats can be set at higher without affecting comfort.	<ul style="list-style-type: none">• Don't set your thermostat at a colder setting than normal when you turn on your air conditioner. It will not cool your home any faster and could result in excessive cooling and higher utility bills.

Appliances

Refrigerator / Freezer

Do's	Don'ts
<ul style="list-style-type: none">• Keep your freezer full. A full freezer will perform better. If your freezer isn't full, fill plastic containers with water and freeze them.• Clearly mark items for quick retrieval.• Turn off empty freezers/refrigerators. You can always turn that unused freezer or second refrigerator when it is needed again.• Unplug unused freezers/refrigerators and remove the door to be sure children cannot be accidentally trapped inside.	<ul style="list-style-type: none">• Don't put hot foods directly in the refrigerator or freezer. Allow them to cool to room temperature first.

Dishwashers

Do's	Don'ts
<ul style="list-style-type: none">• Use energy-saving cycles whenever possible.• Use the no-heat air-dry feature on your dishwasher. If your dishwasher does not have this feature, simply turn off the dishwasher at the end of the wash cycle and open the door to allow the dishes to air dry.• Load the dishes according to manufacturer's instructions and wash only full loads.• If your dishwasher has an accessible filter (at the bottom of the dishwasher), clean it regularly to keep the machine running efficiently.	<ul style="list-style-type: none">• Don't pre-rinse your dishes. Scrape off the food and liquids, and the dishwasher will do the rest. If you must pre-rinse, use cold water.

Stoves / Ovens

Do's	Don'ts
<ul style="list-style-type: none"> • Use microwaves for cooking and reheating small quantities of food. A conventional, full-size oven will consume over five times the electricity for comparable heating. • Use crock-pots and pressure-cookers for appropriate foods. They consume substantially less energy than conventional stove top and oven methods. • Keep burner pans clean. Shiny surfaces will reflect more heat back up to the pan. • Use the smallest pan possible and match the pan size to the element size. • Use copper bottomed pans, which heat faster. • For all but gas stoves, it is important to use flat-bottomed pans to maintain good, efficient contact between the pan and the heating element. • Defrost frozen foods in the refrigerator before cooking to reduce cooking time (and energy use). • Preheat your oven only if you need to, and keep the preheat time to a minimum. • Keep the oven door closed during baking. • If making more than one pan at a time, stagger them so they don't interfere with free air movement. • Use glass or ceramic pans in ovens and reduce the temperature about 25° F. Your food will heat just as quickly. • If you have a self-cleaning oven, use the feature after baking to avoid re-heating just for cleaning. • Keep your microwave clean. Clean surfaces allow more efficient microwave cooking. 	<ul style="list-style-type: none"> • Don't lay foil on the oven baking racks. This interferes with air circulation and extends baking times. • Don't overcook. Use meat thermometers and timers to monitor cooking.

Clothes Washers / Dryers

Do's	Don'ts
<ul style="list-style-type: none">• Use lower temperatures for washing.• Wash only full loads whenever possible.• When drying, separate your clothes and dry similar types together.• Use the automatic drying feature, if your dryer has one, instead of the timer.• Clean the dryer filter after each use.• Periodically check the outside dryer exhaust vent. Make sure it is clean and that the flapper on the outside hood opens and closes freely.• In good weather, hang your clothes outside to dry. Solar drying is free!	<ul style="list-style-type: none">• Don't overdry your clothes. Take clothes out while they are still slightly damp to minimize ironing (another big energy-user). Overdrying is also hard on your clothes and shortens their life.• Don't add wet times to a load that is already partially dry.• Don't overload or underload your dryer. Drying small loads wastes energy. Overloading causes wrinkling and uneven drying.

Maintenance

This section provides general guidelines for routine maintenance of air conditioners, water heaters, and major appliances.

Air Conditioners

Central Air Conditioners and Split Systems

Monthly

- Clean or replace the air filters
- Check the area around the unit and clear away any debris. Leaves and trash can block the vents and prevent interfere with air circulation. Blockages will cause the system to run longer, increasing utility bills and maintenance costs.

Yearly

Have a licensed technician service the system once a year. The technician should:

- Check the coolant level. A system that is 10% low on coolant will cost 20% more to operate. If a system is leaking coolant (freon) by law the leak must be fixed before any more freon can be added. Freon is a chlorofluorocarbon (CFC) and will damage the earth's ozone layer if released into the atmosphere.
- Clean the condenser coils
- Check the amp draw on the compressor
- Oil the fan motors
- Check the belts
- Make sure the operating pressures and temperatures are at the manufacturers specified levels.¹

Inspect the ductwork for central systems to make sure it is airtight and in good condition.

- Have a contractor repair any disconnected, leaky, or damaged ducts. If air is leaking out of your system you are paying to cool spaces you are not using.

Note: Be sure to check customer references before hiring a contractor to perform duct cleaning or other service.

Window Air Conditioners

Monthly

- Clean or replace the air filters. Keeping the filter clean can lower your air conditioner's energy consumption by 5% to 15%.
- Make sure the drain channels are clear. Clogged drain channels will prevent the air conditioner from reducing humidity, and the resulting excess moisture may discolor your walls or carpet. Channels can usually be cleared by passing a stiff wire through them.

Yearly

- Inspect the seal between the air conditioner and the window frame. Holes in the seal will allow cool air to escape from your home.

Water Heaters

All Water Heaters

Once

- Wrap pipes with a diameter equal to or less than 2 inches with insulation of R-4 or greater. Pipes with a diameter of more than 2 inches should be covered with insulation of R-6 or greater.
- Adjust the water heater's thermostat to 120°F unless dishwasher does not have a booster heater.
- Install a heat trap above the water heater. A heat trap is a piping arrangement that prevents hot water from rising up in the pipes, thereby minimizing standby losses.
- For electric water heaters, install a timer that can automatically turn the hot water off at night and on in the morning. A simple timer can pay for itself in less than a year. OR, enroll in a utility electric demand control program using larger storage capacity tanks and timers to limit heating hours to low electric energy use periods (for example, at night and on Sundays, when most businesses are closed).
- For solar water heating systems, install a backup storage tank with an R-value of at least 16. If less, externally wrap backup storage tanks with insulation of R-12 or greater.

Conventional Water Heaters

Every Three Months

- Drain a quart of water from the tank. This removes sediments in the tank that will decrease the water heater's efficiency.

Solar Hot Water Heaters

Be sure to ask your general contractor or solar installer for a maintenance guidelines and schedule when your system is installed. Your contractor should be able to describe to you the unit's basic operating principles. If you understand how your system operates, most maintenance is a simple matter. If you prefer to hire a solar professional, most offer routine maintenance services at reasonable fees.

Every Three Months

- Flush your storage tank. The normal pressure from a city or county water system is sufficient for the flushing. Small bits of debris from your water supply or solar system can collect at the bottom of the tank, and can affect the function of your pump and valves. A water filter on your incoming supply line can be very effective at removing grit and silt from your water supply. If you do have a filter, include changing the filter cartridge on your regular maintenance schedule.

Annually

- Visually inspect your solar system, especially the equipment, such as the collectors, which are always exposed to the elements. Confirm that the sensor is still weather-tight (if you have an AC forced-circulation system.)
- Look for evidence of leaks.
- Examine the pressure-relief valve and air vent on the pipes exiting the collector to ensure that they're operable and not corroded. If there is water dripping from your pressure-relief valve, replace it.
- If there is dirt on the collector glass, rinse it off or clean with mild soap and water. Do this when the glass is cool, on a cloudy day or early in the morning.
- Examine the pipe insulation. It will break down when exposed to ultraviolet radiation, and should be protected from the sun. It can be painted, wrapped in reflective duct tape, or otherwise covered with an ultraviolet-resistant seal. Repaint or re-seal as necessary.
- Monitor the pump's operation (for a forced-circulation system). It should cycle off and on several times during a normal day, and you should have plenty of hot water.
- Check the mounting structure that supports the collectors to make sure it's in good condition. The metal should be solid and not corroded, and the wood should be sound, with no rot or damage. There should be a two-inch air space between the collectors and the roof. Make sure no leaves or other debris are trapped (which can contribute to rot or corrosion) and that no other unwanted material is present (wasp nests, for example).
- The roofing penetrations—where the mounting structure is fastened to your roof system—must also be checked. Often, a simple but effective fastener like a six- or eight-inch lag bolt holds the collector mount to a rafter or perlon. A roofing compound (or “tar”) can be added at the point of penetration to renew the seal, and is easy to apply with a caulking gun.
- Flush your storage tank. The normal pressure from a city or county water system is sufficient for the flushing. Small bits of debris from your water supply or solar system can collect at the

bottom of the tank, and can affect the function of your pump and valves. A water filter on your incoming supply line can be very effective at removing grit and silt from your water supply. If you do have a filter, include changing the filter cartridge on your regular maintenance schedule.

Anode Replacement (Every Four to Six Years)

- Check to see if your system runs hot (with tank temperatures consistently over 150°F). The standard industry recommendation is to replace your anode if the tank temperature runs between 130°F and 160°F, which normally means an anode replacement every four to six years.
- Because the hexagonal head of the rod is sometimes beneath the exterior shell of the tank and use of an impact wrench may be required, this job is often difficult for the do-it-yourselfer. Consider hiring a plumber or solar installer to replace your anode.

Whenever You're Away

If no one will be home to use hot water for an extended period—say, a week or more—take steps to ensure that system temperatures don't get too high while you're gone.

- *For forced-circulation systems.* Before you leave, set the pump switch to “ON” and turn off the back-up heating element. When you are at home, the pump switch will normally be set to “Automatic.” When the switch is ON, the pump will run continuously. While this does use additional electricity (about the same as a light left on for security reasons), it keeps the tank from overheating. The water should be fairly warm when you return and will heat rapidly once the back-up is turned back on.

OR

- *All solar systems.* Cover the solar collectors. Some solar companies have frames with shading screens that fit over the collectors.

Appliances

Refrigerator/Freezer

Semi-Annually (Every Six Months)

- Check the door seals. The door seals or gaskets can deteriorate, greatly increasing energy consumption. To check, put a dollar bill in the door as you close it. If it is not held firmly in place, the seals may be defective. If so, check with your dealer. New seals are expensive. If the seal needs replacement, it may be time to think about replacing the refrigerator/freezer with a new, higher-efficiency model.
- Check the temperature. The refrigerator compartment should be kept between 36°F and 38°F, and the freezer compartment should be kept between 0°F and 5°F. Keeping the settings just 10°F lower than these recommended temperatures can increase energy use by 25%.
- Check for location and clearance. Is your refrigerator in the sunlight or next to your stove or dishwasher? If so, it has to work harder to maintain cool temperatures. Move it to a cooler

location if possible. Also make sure than air can circulate freely around the condenser coils. If air flow is blocked, energy consumption will increase.

- Check the power-saver switch. Some refrigerator models are equipped with wall heaters to prevent outside condensation. On newer units, you can turn off this energy-consuming features. Unless you have noticeable condensation, keep the power-saving switch on the power-saving setting.
- Check for the need to defrost. If you have a manual defrost refrigerator or freezer, defrost on a regular basis to prevent build up of ice on the coils inside the unit.
- Vacuum the coils. Vacuuming the coils periodically keeps them free of dust and debris that can affect their operational efficiency.

¹ Garrett, Doug. “Service Your Air Conditioner for Summer Comfort” Austin American Statesman. City of Austin Green Builder Program. www.greenbuilder.com.

Appendix F: Equivalencies for Energy Star® Homes in Hawaii

Homes without Air Conditioning

Homes without air conditioning participating in the solar domestic water heating programs of HECO, MECO, and HELCO comply with the requirements of the ENERGY STAR® Homes Program. A post-installation inspection is required.

Homes with Air Conditioning

New homes with air conditioning that are built to the *Hawaii Model Energy Code – Low Rise Residential Requirements for Air Conditioned Homes* can also be ENERGY STAR® compliant if the additional measures are implemented from one of the following option packages below:

Option 1 (Homes with Standard Windows and Ducts in Unconditioned Space):

1. Use double pane windows with total unit solar heat gain coefficient (SHGC) less than or equal to 0.55 (for example, clear, Low-e, or tinted). Total window area must be less than 18% of the conditioned floor area, and less than 62.5% of the total window area can be oriented on the south and west sides combined.
2. Use a programmable thermostat.
3. Use a minimum 12 SEER air conditioner.
4. Have duct unions and joints thoroughly and completely sealed with mastic and fibrous tape and verify with a visual inspection.

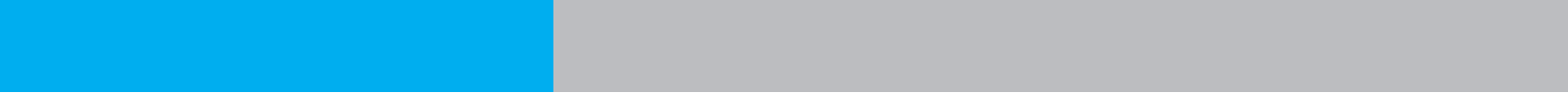
Option 2 (Homes with Standard Windows and Ducts in Conditioned Space):

1. Use double pane windows with total unit solar heat gain coefficient (SHGC) less than or equal to 0.55 (for example, clear, Low-e, or tinted). Total window area must be less than 22% of the conditioned floor area, and less than 62.5% of the total window area can be oriented on the south and west sides combined.
2. Use a programmable thermostat.
3. Use a minimum 12 SEER air conditioner.

Option 3 (Homes with High Performance Windows and Ducts in Unconditioned Space):

1. Use double pane windows with total unit solar heat gain coefficient (SHGC) less than or equal to 0.40 (for example, Low-e, or tinted). Total window area must be less than 25% of the conditioned floor area, and less than 62.5% of the total window area can be oriented on the south and west sides combined.
2. Use a programmable thermostat.
3. Use a minimum 12 SEER air conditioner.
4. Have duct unions and joints thoroughly and completely sealed with mastic and fibrous tape and verify with a visual inspection.

Note: With all options, a post-installation inspection is required.



Appendix G: Utility Co-Payments

Hawaiian Electric Co., Inc. (HECO)

Residential Efficient Water Heating Program

Financial Co-Payment Levels*

Effective 4/20/00

Technology		Retrofit	New Construction
Solar Water Heating System		\$500	\$1,000
Heat Pump Water Heater		\$175	\$300
High-Efficiency Electric Water heater	EF**		
35 gal. tank or less	0.94	\$40	\$60
36-45 gal. tank	0.93	\$40	\$60
46-64 gal. tank	0.92	\$50	\$80
65 gal. tank	0.91	\$50	\$80
66 gal. tank or greater	0.88	\$70	\$80
Tank and Timer			
80+ gal. tank with timer	0.88	n/a	\$270***

* Co-payment levels are subject to change without notice.

** EF ratings are minimums based on most recent GAMA certified ratings.

*** Customers who have an 80+ gallon tank installed with a load control timer are eligible to receive a \$5.00 per month credit on their electric bill.

Hawaiian Electric Light Co., Inc. (HELCO)

Residential Efficient Water Heating Program

Financial Co-Payment Levels*

Effective 5/01/00

Technology		Retrofit	New Construction
Solar Water Heating System		\$1,000	\$1,000
Heat Pump Water Heater		\$175	\$300
High-Efficiency Electric Water heater	EF**		
35 gal. tank or less	0.94	\$40	\$60
36-45 gal. tank	0.93	\$40	\$60
46-64 gal. tank	0.92	\$50	\$80
65 gal. tank	0.91	\$50	\$80
66 gal. tank or greater	0.88	\$70	\$80

* Co-payment levels are subject to change without notice.

** EF ratings are minimums based on most recent GAMA certified ratings.

Maui Electric Company, Ltd. (MECO)
Residential Efficient Water Heating Program
Financial Co-Payment Levels*
as of 11/01/98

Technology		Retrofit	New Construction
Solar Water Heating System		\$1,000	\$1,000
Heat Pump Water Heater		\$275	\$725
High-Efficiency Electric Water heater	EF**		
35 gal. tank or less	0.94	\$40	\$60
36-45 gal. tank	0.93	\$40	\$60
46-65 gal. tank	0.92	\$50	\$80
66 gal. tank or greater	0.88	\$70	\$80

* Co-payment levels are subject to change without notice.

** EF ratings are minimums based on most recent GAMA certified ratings.

Kauai Electric

Energy Wise Residential Retrofit Program

Summary of Residential Water Heating Incentive Rebates (July 2000)

Cost/Benefit Assessment and Recommendations

Kauai Electric's Energy Wise residential program starts with a home visit to any household that heats water with a conventional electric heater or a solar system with an electric backup. During the home visit, the energy auditor checks the water heating system and where appropriate, installs energy-saving showerheads, faucet aerators, and tank wraps. Water heater temperature settings may be lowered. Heavily used incandescent lighting may be replaced with compact fluorescent lamps. These are provided at no cost to the customer.

During the home visit, the auditor also gathers information about the household occupancy, their hot water use, and the feasibility of installing a heat pump or solar water heating system (space and insulation factors). This information is compared with the household's historic energy use taken from the bill history of that account. If the estimated lifetime savings for an installation is equal to or greater than the estimated cost of a system, a recommendation and offer for an incentive rebate is mailed to the customer, with an explanation of procedure and a list of participating installation contractors. Incentive rebates are offered only when the maximum allowable cost for a solar water heating system is greater than \$3,268 or if the maximum allowable cost for a heat pump is greater than \$2,400.

Owner Occupant

When the customer is an owner-occupant, the incentive rebate is 45% of the installation cost, which cannot exceed the maximum allowable cost.

Income-Qualified or Rental Unit

When the customer qualifies under federal income guidelines, or when the customer is a tenant and the landlord is willing to participate, the incentive rebate is 70% of the installation cost, which cannot exceed the maximum allowable cost.

New Construction

When a house is being built for an owner-occupant (not speculative construction), and the owner is intending to install regular electric water heating (the house is wired for an electric water heater—no pre-existing gas piping or solar water heating plumbing), a review for cost effectiveness of a solar water heating system is made using estimates of water heating energy requirements based on household size. If cost effective, the incentive rebate is 80% of the maximum allowable cost less \$500 (to account for the conventional electric water heater the customer would have otherwise installed).

General Comments

Although customers are not required to get multiple bids, they are encouraged to do so because they will still pay for most of the installation cost.

In addition, Hawaii State energy income tax credits of 35% of the customer's portion may apply.

Calculations for Solar Hot Water Savings – Approximations – Oahu (Source: DBEDT)**Adjusted Solar Hot Water System Cost**

System Installed Cost	\$4,000
Utility Rebate	-500
	<hr/> \$3,500
Tax Credit (35%)	-1,225
	<hr/> \$2,275
Adjusted Cost	\$2,275

Solar Hot Water Savings After 20 Years

Yearly savings (\$626/yr.)	\$12,520
HECO Rebate	500
Tax Credit	\$1,225
	<hr/>
Total	\$14,245

Solar Hot Water Monthly Savings**Assumptions:**

- 100kWh per person per month for water heating.
- 14.5 cents per kWh electricity cost.
- Solar hot water provides 90% of hot water needs.

Calculation:

100kWh x \$0.145 = \$14.50 per person per month.

\$14.5 x 4 people = \$58 per month.

\$58 x 12 months = \$696 per year.

\$696 x 90% = \$626.40

Appendix H: Certification Programs and Other Resources

Reputable certification programs help identify environmentally preferable products. Suppliers have recognized the importance of increasing the credibility of environmental claims and have begun to certify those claims using industry or independent certification programs. Independent programs will provide the most objective documentation. Two programs that certify energy-efficient building products include:

- **Green Seal:** Green Seal standards are based on environmental protection. They focus on reduced air and water pollution, reduced consumption of energy and other resources, protection of wildlife and habitats, reduced packaging, quality, and performance, 202-588-8400, www.greenseal.org.
- **Energy Star®:** A program of the federal government, manufacturers are allowed to use the Energy Star® label only if the product meets certain energy efficiency levels developed by either the U.S. Environmental Protection Agency or U.S. Department of Energy, 888-STAR-YES, www.energystar.gov.

“Branding” the Extra Value of an Energy-Efficient Home

- The EPA’s Energy Star® performance standards for homes in Hawaii (see Appendix F for Hawaii equivalencies) documents your home’s energy performance for the purpose of Energy Efficient Mortgage qualification *and* helps you “brand” your home(s) as extra energy-efficient. The Energy Star® program provides builders enrolled in the program with marketing materials. For more information: 888-STAR-YES, www.energystar.gov.
- The National Home Builders Association Research Center recognizes high energy-efficient performers through its annual “Energy Value Housing Award” program. 800-638-8556, ext. 6192, www.nahbrc.org, or e-mail at evha@nahbrc.org.
- On May 15, 2001, a model demonstration home built to the State’s *Energy Efficiency Guidelines* (see page 3) was dedicated as the First Hawaii BUILTGREEN™ Home in the state (see Appendix I for Case Study). That means it not only met the intent of the *Guidelines*, but it met a set of “green” criteria developed by the Building Industry Association of Hawaii (BIA) in partnership with government and utility representatives. These criteria were reviewed and approved by developer members of the BIA. The Hawaii BUILTGREEN™ program is a voluntary program where home projects are certified by the builder to include energy efficient, materials efficient, improved air quality, and site protection features. For more information about the program, please call the BIA-Hawaii at 847-4666.

Energy-Efficient Product Directories

Several good directories identify environmentally preferable products. Those that address energy efficiency include:

- *REDI Guide (Resources for Environmental Design Index)*, web database, diskette, or printed handbook. Available from Iris Communications, Eugene, OR, 800-346-0104, or at www.data.oikos.com/products.

- *Consumer Guide to Home Energy Savings*, by Alex Wilson, Jennifer Thorne, and John Morrill. Available from the American Council for an Energy-Efficient Economy, Washington, DC, 202-429-0193, or at www.aceee.org.

Energy Efficient Financial Incentives

Contact your local utility for information on current utility rebates for solar water heater systems:

- Hawaiian Electric Company (Oahu): 947-6937.
- Hawaii Electric Light Company (Big Island): 969-0127.
- Kauai Electric: 246-8280.
- Maui Electric Company (toll free): 1-888-632-6786.

For more information on the State Income Tax Credits for solar water heater and other energy systems, call the State Department of Taxation, 587-4242 (Neighbor Islands toll-free, 1-800-222-3229).

Appendix I: Case Study – Model Demonstration Home

The First Hawaii BuiltGreen™ Home and Oahu's First Energy Star® Home*

- Energy Efficiency
- Comfort without air conditioning
- Environmentally responsible/HABiT (Hawaii Advanced Building Technologies Training Program) construction practices



Project Description

The First Hawaii BuiltGreen™ Home was designed for the State Department of Hawaiian Home Lands in a cooperative project supported by the U.S. Department of Energy, DBEDT, DHHL, the Honolulu Chapter/AIA, Building Industry Association of Hawaii, Honsador Lumber Corporation, and HECO. The home incorporates affordable techniques derived from the State's *Energy Efficiency Guidelines* and the HABiT guide to provide energy efficiency and comfort without air conditioning. It was built in Waianae Valley, Oahu, and dedicated on May 15, 2001. The following are some basic facts about the Home:

- A. Incorporated the money-saving “Three Big Bang Technologies”:
1. HECO-approved solar water heater
 2. Radiant barrier
 3. Natural ventilation
- B. Cost: Under \$128,000 (not including the land); land area: 8,146 sq. ft.
- | | |
|------------------------------|--------------------|
| 4-bedroom, 2 1/2 bath | |
| Interior floor area: | 1,259 sq. ft. |
| Covered lanai & entry porch: | 106 sq. ft. |
| Garage | |
| Laundry & half bath: | 108 sq. ft. |
| <u>Parking area:</u> | <u>372 sq. ft.</u> |
| Total: | 1,845 sq. ft. |

Construction:

Commencement: February 2001

Completion: May 2001

Project Partners:

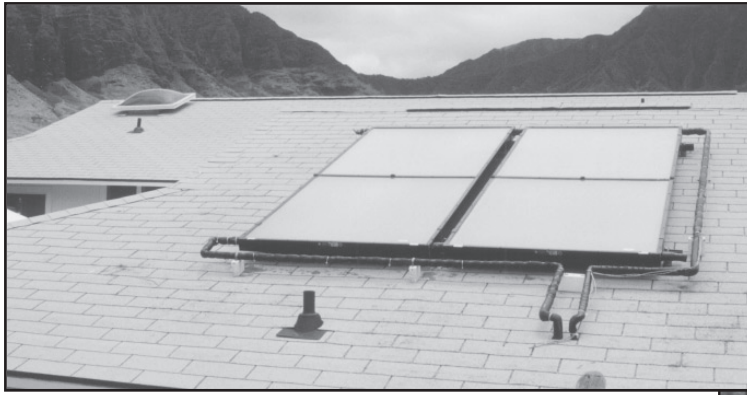
- ◆ U.S. Department of Energy
- ◆ State Department of Business, Economic Development & Tourism
- ◆ State Department of Hawaiian Home Lands
- ◆ Honsador Lumber Corporation
- ◆ Building Industry Association of Hawaii
- ◆ Honolulu Chapter, American Institute of Architects
- ◆ Hawaiian Electric Company, Inc.



Special Features

Energy efficiency, comfort, value, and environmentally responsible building strategies used in the design and construction of the First Hawaii BuiltGreen™ Home include:

1. Orientation of the house on the lot to minimize solar heat gain and improve exposure to trade winds and cross ventilation.
2. Light colored roofing to reduce solar heat gain.
3. Roof ridge and soffit vents to vent heat from attic spaces.
4. Polyethylene bubble insulating radiant barrier in the attic.
5. Radiant barrier bonded to particle board roof sheathing.
6. Polyethylene bubble insulating radiant barrier in walls exposed to high sun levels.
7. Generous eaves for window and wall shading.
8. Shading of south-facing walls by the carport and of the east wall by the entry porch.
9. Light colored finishes on the exterior to reduce heat gain.
10. Generous window openings with window selected to provide ample light and ventilation while reducing heat gain on the west side of the house.



Above: Venting skylight on leeward side of the roof draws out hot air. Solar panels, shown on the carport roof, help to reduce utility bills by about 40%, saving about \$626 per year.

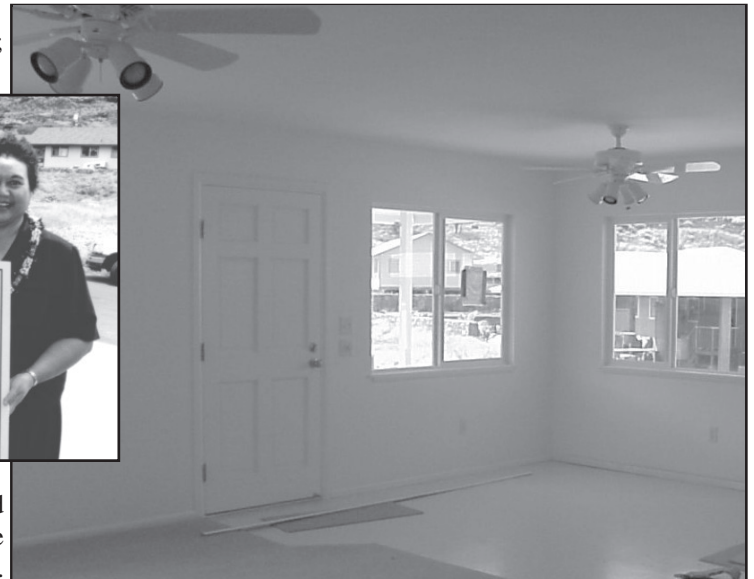


Above: Astro-E was draped from the rafters and nailed outside the studs. The radiant barrier reflects the sun's heat, helping the home to be comfortable without air conditioning.

Below: The Building Industry Association of Hawaii, the developer of the Hawaii BuiltGreen™ Home, received a \$1,000 rebate check from HECO. L-R: Karen Nakamura, BIA Executive Director; Audrey Hidano, BIA Past President; Randy Lau, BIA President; and Jackie Mahi Erickson, HECO Vice President.



Right: Light-colored interiors and ceiling fans helped to keep the home cool. Large windows provide natural ventilation and daylighting.



11. Ventilating skylight to remove heat and improve lighting and air circulation in the hall way.
12. Louvered doors at some bedrooms to improve air circulation.
13. Open living, dining, kitchen area floor plan with the kitchen located on the leeward side of the house to improve air circulation and the removal of kitchen heat and humidity from the home.
14. Front screen door so that the front door can be left open for improved ventilation.
15. Screened operable glazing at the kitchen door for improved ventilation.
16. Ceiling fans to improve comfort on warm days.
17. Stove venting to remove cooking heat.
18. Location of the laundry in the carport to remove heat and humidity from the house.
19. HECO-approved solar hot water heater.
20. Microwave oven to reduce conventional oven use.
21. New generation high efficiency refrigerator.
22. Light colored finishes in interior spaces to increase the efficiency of daylighting.

23. Use of fluorescent lighting wherever possible, including the provision of compact fluorescent bulbs in recessed ceiling lights in the hallway.
24. Raised pier foundations to provide cooling air flow under the home and easy visual inspections to reduce the risk of ground termite infestation.
25. Use of cast concrete caps on concrete masonry unit columns and footing piers to reduce the risk of ground termite infestation.
26. Use of borate treated lumber and wood products.
27. Use of recycled plastic materials (Trex®) that resist rot and termites for deck surfaces.
28. Use of oriented strand board for roof sheathing.
29. Roof and floor plan dimensions scaled to fit standard material sizes to reduce waste.
30. Provision of generous hall, bathroom and door widths to improve accessibility and ease of use.
31. Use of recycled, crushed concrete for fill material under the garage and driveway slabs.
32. Spreading of excavated soil on the site to reduce hauling costs.
33. Implementation of a construction waste management program during the construction process.
34. Use of carpet with recycled content.

*** Energy Star® Homes:** *Non-air-conditioned new homes with an Hawaiian Electric Company-approved solar water heating system qualify for an Energy Star® Mortgage, which provides home owners with increased buying power. Call HECO (947-6937) for more information.*

